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THE IMPACT OF THE EARLY MOBILIZATION ON THE HOSPITAL STAY AND INDEPENDENT FUNCTION OF BURN PATIENTS

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ABSTRACT

Aim: Burn and injuries associated with it are one of the factors leading to death and disability around the world. Musculoskeletal complications are seen commonly after burning. Thus, rehabilitation programs play major role in improving the functional and psycho-social status of burn patients. They help patients obtain independent function and return to society and work. Accordingly, the present study was conducted to develop an early motor program according to available scientific evidence and to evaluate its impact on duration of hospitalization and independent function of burn patients.

Material and Method: The current research is a clinical trial study, in which 124 patients hospitalized in the burn wards of Sina Educational and Medical Center were participated in the form of control and intervention groups. The control group received routine care and the intervention group received an early mobility program. This early mobility program was developed by the research team based on nursing texts on burn. Independent function scale included two motor and cognitive subscale. Score 1 to 7 was assigned for each part of different motor and cognitive subscale according to degree of dependence of patient in performing the related activities, so that score 7 suggests maximum independency in performing the related activities, while score 1 suggests the minimum degree of independency in performing the activities. It assesses the function of patients in terms of independence and dependence at seven levels. This scale was completed for both groups at discharge time and three months later. The collected data were analyzed using SPSS-24 software and Mann-Whitney and Wilcoxon tests.

Results: Significant difference was observed in score of independent function at time of discharge and three months later and it was higher in intervention group in the motor subscale in the part of ability to self-care. Additionally, significant difference was observed in the subscale of ability to move in terms of level of ability to transfer, displace, and mobility. In cognitive subscale, significant difference was found in part of social activity, comprehension, writing, social interaction, speaking, adaptation to limitations, using leisure time, problem solving, memory, awareness, concentration, and safety awareness. Findings related to comparison of total scores of independent function in two control and intervention groups at the time of discharge and three months later revealed significant difference between the two groups in part of self-care and ability to move in the motor subscale at time of discharge and three months later. Scores of independent function were higher in intervention group. Independent function scores in the cognitive subscale in parts of social activities, writing, emotional state, adaptation to limitations and using leisure time, problem solving, memory, awareness, concentration, and right judgment on the main issue were higher in the intervention group, compared to control group.

Discussion: findings related to independent function at time of discharge and three months later in control and intervention groups revealed that the mobility protocol had an impact on the motor and cognitive subscale and it increased independent function score. It also decreased the duration of hospitalization in burn patients. It is recommended that a comprehensive plan to be developed at the level of burn centers so that the effectiveness of this plan to be proved and it is notified and implemented as a comprehensive protocol. It is also recommended that this plan to be included as part of the routine methods in nursing care provided for burn patients.

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Introduction

Burn and injuries associated with it are one of the factors leading to death and disability around the world (1). Based on statistics released by WHO, more than 265000 people around the world die due to injuries resulting from burn, and its

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survivors encounter with considerable functional limitations and disabilities (2). Musculoskeletal complications are seen commonly following the burn. These complications include contracture, loss of bone, scoliosis and kyphosis, joints dislocation or displacement, loss of muscle mass, and limb amputation. Heterotopic ossification resulting from burn leads to reduced ROM, joint dysfunction, and impairments in activities daily living. In addition, pain in joints, joint stiffness, difficulty in walking and running, fatigue, weakness of the arms and hands, limitation in moving the neck, arms and underarms, and even dysfunction in movement, self-care, and disruption in function of hands, and playing role are seen after burning(3). On the other hand, contracture defined as disability in range of motion, is one of the key factors of disability in burn patients, so that it leaves destructive impact on the quality of life and people ability in performing the daily activities. In addition, the contracture increases patient need for surgical treatments, followed by limitation in returning to work (4). Range of motion limitation of limbs up to 5 years after injury and appearance deformities in in minor burns cause work problems or permanent disability in performing the work (5) and all of these factors functional independently and affect quality of life of burn patients (6, 7). Researchers believe that immobility is one of the main factors affecting the physical function (5, 8, 9), so mobility and exercise should be an integral part of the care programs provided for burn patients. Movement as physical activity has been defined to eliminate acute physiologic complications, increasing the ventilation, increasing the central and peripheral perfusion, improving the blood flow and muscle metabolism, and venous stasis. Early mobility also involves using physical activity within 5 to 2 days after illness or injury (10). Research indicates that mobility and exercise increases size and strength of muscles and thereby fight against muscle atrophy (5), stimulating the growth of muscles and synthesizing proteins (9). Hence, rehabilitation programs play major role in improving the functional and psychosocial status of burn patients, since they help them in obtaining independent function and returning to society and work (11). Physical rehabilitation plays key role in improving the burn wounds of patients and increasing their capability to maintain their independence and useful life. It also helps in achieving the maximum physical and functional strength and adapting to permanent disabilities and achieving the roles and skills of life (2). Research also suggests that an early and special rehabilitation program can be useful in physical, psychological, and functional rehabilitating of burn patients (12). A study carried out on the grafted lower limb indicated that starting a movement 24 hours after surgery is a safe way in preventing the long-term hospitalization complications (13). Thus, objective of this study was to answer the question of whether early mobility can decrease musculoskeletal disorders and lead to improved independent function (14). On the other hand, the number of scientific evaluation of early mobility in burn wards is limited and there is not adequate information on using it in this area. This limitation is more considerable for patients hospitalized in burn wards, especially in early mobility programs (15). Given the prevalent culture of immobility of burn patients in burn wards and complications of immobility in this group of patients (8), the objective of this study was to develop an early mobility program according to available scientific evidence and to evaluate its impact on duration of hospitalization and function of organs in burn patients.

Methodology

Location and population of study

This research is a clinical trial study conducted at Sina Educational-Medical Center, affiliated to Tabriz University of Medical Sciences, Iran. This center is considered as the only northwest burn center where burn patients from various cities including Urmia, Ardabil, Sanandaj, and so on are admitted. This center includes several burn wards including male burn ward, female burn ward, children burn ward, and burn ICU. In addition, there are two reconstructive wards for performing aesthetic surgeries and a burn clinic for providing the care for burn patients after discharge. In total, there are 44 hospital beds for burn patients, and 80 patients per month are hospitalized in these wards. Samples of study were selected in this study among from patients admitted in the burn wards after they met the inclusion criteria and they were placed in control and experimental groups using simple random method. Inclusion criteria of study included people who were at the age range of 15-60, patients weighted less than 100 kg and with a burn percentage of up to 60%, both male and female genders who had an unintentional burn, and lack of any organic and systemic disorder before burn. Exclusion criteria of study included unpredicted medical disorder such as mechanical ventilation, lack of cooperation of patient, and any specific defect in organ due to burn such as blindness, amputation, and so on. As there was similar study and given the type of study, it was impossible to conduct a pilot study to determine the sample size of study. Thus, using G Power software, the minimum sample size required to compare the ratio of percentages of improvement in independent function in the control group and experimental group was obtained 64 people for each group, with 95% confidence and 80% power, and considering P1 = 0.5. Then, the samples were placed in control and intervention groups according to random number table. Patients in the control group received routine care and experimental group received early mobility program (Figure 1). Data related to independent function were collected using relevant tool.

Tool

The motor and cognitive function of burn patients was measured in this study using Functional Independent Measure. This tool includes two subscale: motor and cognitive parts, measured in seven levels of complete independence, change in independence, need for monitoring, need for minimum help, need for moderate help, need for maximum help, and dependence. The part related to motor level includes self-care, repulsing, transferring and displacement skills, which each of them is composed of several parts, for example, self-care is measured based on the ability to eat, bathing, wearing cloth for

upper limbs, wearing cloth lower limbs, and ability to go WC .In the repulsing area, urinary and stool control is measured, and in the transferring area, ability to transfer to bed, transfer to bathroom and transfer to bath are measured. The displacement area is also measured based on the level of ability to walk and climb stairs. The cognitive subscale of the functional independent tool is also measured in the following areas: social, psycho-social, and cognitive interactions examined in the part of social interactions, social activities, speaking, comprehension, reading, writing and speech comprehensibility. In the psychosocial part, emotional state, adaptation to limitations, and the use of leisure time are examined. In the cognitive part, problem solving, memory, awareness, concentration, and right judgment on main issue is examined. Score 1-7 is assigned for each area of different motor and cognitive levels according to degree of dependence of patient in performing the relevant function. Score 7 was assigned based on the degree of patient's dependence in performing the relevant function. Score 7 is the complete independence of the patient in carrying out the related activities, while score 1 indicates the lowest degree of the patient's independence in performing the activities (12). To assess the validity of tool, experts' view was used. The questionnaire was distributed among 10 professors of the Tabriz University of Medical Sciences who had specialty in the area of burning. After collecting their views, required changes were applied in the tool and its validity was calculated. In addition, reliability of tool was measured using Cronbach's alpha. The reliability of the motor part was obtained 0.94 and the cognitive score was obtained 0.90. Data were collected by this tool at time of discharge and three months later.

Data collection

According to review of the literature on subject of burn and its nursing care and based on research carried out on burn, a draft of early mobility program of burn patients was developed, and it was sent to professors who were specialist on burn. Obtaining their views and applying required changes in the mobility program, the final version of the program was developed and implemented (Figure 1). Sampling was started after obtaining ethical code from the Ethics Committee of Tabriz University of Medical Sciences (TB Zmed.REC.1394.751) and recording in the clinical trial system (IRCT2016050827561N2) and obtaining the permission of the head of the Sina Educational-Medical Center, and head nurses working in the female and male burn ward. Patients were matched in both groups in terms of percentage of burn, burn in upper limb, burn in lower limb, burn in face, age and gender. Then, both groups were examined and compared in terms of duration of hospitalization and independent function at the stage of discharge and three months later. Accordingly, the control group received only routine burn cares, while the intervention group received an early mobility program based on the developed program (Figure 1). Then, independent function measure was completed for each patient by the researcher at time of discharge and three months later. The collected data were analyzed using SPSS 24 software. U-Mann-Whitney test was used in order to compare the total scores obtained from independent function ranks in control and intervention groups. The Wilcoxon signed-rank test was also used to compare the total scores of repeated ranks at time of discharge and three months later. Significance level was considered at the level of 0.05 in all tests.

Table 1- early mobility program

Physician visits the patient first and allows the moving. Then, the patient is visited by a physiotherapist, and he determines type of active and inactive exercises that can be performed in the bed.
Stage 1: Informed consent is taken from patient. If the patient is not feeling well, or his hemodynamic condition is unstable for moving out of the bed, passive exercises are given by nurse on the bed. If the patient is feeling well to perform activities, active exercises are performed on bed. These exercises are continued up to the stage that the patient finds the power to sit on the bed without support. These exercises will be performed three times per day (once per shift). After each time of performing exercise program, the power to sit on the bed is controlled without support, and if the patient's hemodynamic condition is stable, he goes into second stage of the program. Stage 2: in this stage, patient is transferred from bed to the bedside chair with help of nurse and he sits on the chair. It starts once per day and increases to three times per day by evaluating the hemodynamic condition. If the hemodynamic condition is stable, the patient goes to third stage. Stage 3: Patient starts walking. It starts from five steps and increases gradually. If the legs are weak and if the patient is not able to walk, the second phase should be prolonged. Stage 4: walking of patient is prolonged. Stage 5: walking sessions are increased. -It is usually expected that patients to go through all five stages. However, the patient recovery process, the severity of burn, and the place of burn will be effective during these stages. - Note (1): when patient is walking, wheelchair and oxygen cylinder should be accessible, and when the hemodynamic condition is unstable and in the case of patient's fatigue, the patient should be returned to the bed. - Note (2): unstable hemodynamic condition is feeling dizziness and fall, cold sweat, paleness, and 100<HR 110, 100>BP, 88%>saturation, assessed and recorded before and after the patient's movement.

Findings

Results revealed that out of 124 patients studied, 67 were male (54%) and 57 were female (46%). Most of studied subjects (68.5%) had a moderate economic status and most of the subjects (65.6% of males and 35.08% of females) had grade 2 and grade 3 burn. Most of the burn areas were related to the limbs (arms and legs), so that 53.7% of the males and 57.8% of the females had this type of burn, and 32.25% of the burns were related to the trunk and 6.6% of the burns were related to head and face. Most of the studied subjects (33.66%) were burnt due to hot liquids, followed by flame (31.45%) and the semi-solid materials (10.48%), respectively. In addition, 2.4% of patients had mild burn and 63.70% of patients had moderate burn, and 33.78% had severe burns .In comparing the independent function scores at time of discharge and three months later in the motor subscale related to independent function measure in the area of self-care using the Mann-Whitney test, significant difference was seen in items of sorting, showering, wearing cloth for upper and lower limbs (P <0.0001). However, no significant difference was seen in items of eating (P = 0.15) and swallowing (P = 0.304) and urinary control (P = 0.156) and stool control (P = 0.55) .Additionally, comparing independent function scores at time of discharge and three months later showed no significant difference in the area of ability to move in parts of displacement to the bed / wheelchair / chair at time of discharge (P = 0.121) , while significant difference was found three months later (P <0.0001). In other parts, such as transferring (going to WC), displacement (showering, driving a car), mobility (walking and moving with wheelchairs and moving in the stairs), significant difference (p <0.0001) was found at time of discharge and three months later .In comparing the independent function scores at time of discharge and three months later in the cognitive subscale, significant difference was found in the areas of social activity, comprehension, writing, social interaction, speaking, adaptation to limitations, using leisure time, problem solving, memory, awareness, concentration, and safety awareness (P <0.0001) and intervention group scores was higher in these areas. However, in no significant difference was found in areas of emotional state (P = 0.263) and speech comprehensibility (P = 0.096)). Findings related to comparing total independent function scores in two groups of control and intervention at time of discharge and three months later by using the Wilcoxon test revealed significant difference between two groups at time of discharge and three months later in the areas of self-care, eating, self-sorting, bathing/showering, wearing cloth for upper limb, wearing cloth for lower limb, and going to WC (p <0.0001), and the score of intervention group was higher in all of these areas. However, no significant difference was found in the areas of swallowing (P = 0.081), urinary control (P = 0.156) and stool control (P = 0.081)). Significant difference (p <0.0001) was found between two groups at time of discharge and three months later in the subscale of ability to move in all parts, so that intervention group score was higher .In the cognitive subscale, significant difference was found between two groups in the areas of social activities, writing, emotional state, adaptation to limitations, using leisure time, problem solving, memory, awareness, concentration, and right judgment on the main issue (P <0.0001) at time of discharge and three months later, so that scores in the intervention group followed an increasing trend. However, significant relationship between control and intervention groups was not observed in the parts of speaking (P = 0.081) and comprehension (P = 012), speech comprehensibility (P = 0.043) and reading (P = 0.55).

Subscale	parts	Items	Mean of ranks in groups at the discharge time		P value at the discharge time	Mean of ranks in groups three months after discharge		P value three months after discharge
			control	Intervention	P value	control	Intervention	P value
motor	self-care part	Eating	57.95	70.05	0.15	51.69	73.31	<0001
		Self-sorting	48.67	76.33	<0001	46.77	78.23	<0001
		Showered / showered	43.97	81.03	<0001	46.77	78.23	<0001
		Wearing cloth for upper limbs	44.34	80.66	<0001	47.26	77.74	<0001
		Wearing cloth for the lower limbs	45.54	79.46	<0001	47.26	77.74	<0001
		WC	47.69	77.31	<0001	58.57	66.43	<0001
		Swallowing	61.48	63.52	0.304	61.00	64.00	0.081
		Urinary control	61.50	63.50	0.156	61.50	63.50	0.156
		Stool control	61.99	63.01	0.554	61.00	64.00	0.081
	motor	Displacement: Beds / chair / wheelchairs	57.58	67.42	0.121	48.38	76.62	<0001
		Transferring: going to the bathroom	54.73	70.27	0.014	48.96	76.04	<0001

	part	Displacement: showering / bathing	55.07	69.93	0.019	47.05	76.53	<0001
		Displacement: car	54.37	70.63	0.010	47.05	77.95	<0001
		Mobility: Walking / Walking with Wheelchairs	54.88	70.12	0.016	48.60	76.40	<0001
		Mobility: stairs	54.36	70.64	0.010	47.58	77.42	<0001
Cognitive	Social interactions	Social activity	55.67	69.33	0.029	50.88	74.12	<0001
		talking	60.51	64.49	0.097	61.00	64.00	0.081
		Comprehension	59.00	66.00	0.007	59.50	65.50	0.012
		Reading	61.99	63.01	0.554	61.00	64.00	0.081
		Writing	56.44	68.56	0.005	55.10	69.90	<0001
		Speech comprehensibility	60.50	64.50	0.096	60.50	64.50	0.043
	Socio-psychological	Social interaction	57.92	67.08	0.008	57.59	67.41	<0003
		Emotional state	59.90	65.10	0.263	54.50	70.50	<0001
		Adaptation to limitations	54.83	70.17	0.003	51.69	73.31	<0001
		Using leisure time (alternative for main job)	54.62	70.38	0.004	49.21	75.79	<0001
	cognitive	Problem solving	53.65	71.35	<0001	53.65	71.35	<0001
		Memory	55.45	69.55	<0001	56.00	69.00	<0001
		Awareness	57.48	67.52	<0002	57.00	68.00	<0001
		Concentration (paying attention to main issues)	56.96	68.04	<0001	56.00	69.00	<0001
		Safe awareness (right judgment on the main issue)	52.58	72.50	<0001	52.50	72.50	<0001

Discussion

The present study was conducted to develop an early mobility program based on available scientific evidence and to evaluate its impact on duration of hospitalization and function of organs in burn patients. Statistics related to independent function at time of discharge and three months later in the control and intervention groups revealed that the motor protocol affected motor and cognitive domains, and it increased the FIM rating. It also decreased the duration of hospitalization in burn patients. This result was consistent with findings of other studies. For example, in a study conducted by Manual Gomez et al, findings revealed that rehabilitation decreases duration of hospitalization. In addition, independent function in patients underwent rehabilitation was better than that in the group receiving routine care. The present study also revealed that patients who were hospitalized in rehabilitation centers have less hospitalization duration and their independent function was better than others (11). This study revealed that the early mobility program was effective in parts of sorting, showering, and wearing cloth for the upper limb. However, it had no impact on items of eating, swallowing, and urinary and stool control. It seems that burn in face and head to be the less common types of burn among patients and most of subjects had no problems with eating and swallowing, and urinary and stool control since the beginning, so no impact was seen on these parts during the intervention .In addition, comparing two groups in the area of ability to move showed that early mobility was effective in all parts (displacement to the bed / wheelchair / chair, transferring (going to WC), displacement (showering, driving a car), mobility (walking and moving with wheelchair and moving on stairs) With wheelchairs and moving stairs). It seems that burns in hands and feet to be the most common type of burn among the subjects, so early mobility could have a higher impact on improving the function of organs. Findings of a study conducted on 138 patients by Spiers et al, revealed that function of patients underwent rehabilitation from admission to discharge was improved. Additionally, significant difference was seen in rank of FIM scale in the group underwent rehabilitation, while this difference was significant in motor subscale and significant difference was not found in cognitive subscale (12). Findings of the present study were inconsistent with this study in the cognitive subscale, but it they are in line with each other in the motor subscale. Findings of a study conducted by Eybid et al indicated that isokinetic exercises might improve the function of quadriceps muscle and other parameters of walking burn children (5). A study conducted in China by Yen Sen et al (2015) under title of "guidance for the rehabilitation of burn patients in China" revealed that exercise can help in maintaining the ROM, increasing muscle strength, increasing resistance, and improving the function (16). In addition, a study conducted by Dan Tang et al revealed that early

rehabilitation improves self-care (17). Results of this research were in line with results of the present study. A cohort study carried out by Jan Deng et al in 2016 during two years on 73 patients hospitalized in the burn intensive care ward revealed that the quality of self-care in patients underwent rehabilitation protocol was higher three months later compared to those who received routine care (18). In addition, it was found that rehabilitation can increase ADL and range of motion, muscular strength, balance ability and motor function. This study revealed significant difference in duration of hospitalization in the BICU ward and range of motion in the injured joints in a group of burn patients underwent mobility exercises. Results of this study are in line with results of present study (17). Findings of the present study revealed that early mobility in the cognitive subscale effected the parts of social activity, comprehension, writing, social interaction, speaking, adaptation to limitations, using leisure time, problem solving, memory, awareness, concentration, and safety awareness (right judgment on the main issue), but it showed no impact in parts of emotional state, comprehensibility of speech and reading. Studies indicate that burn patients have problem in cognitive skills (18, 19) and they have lower cognitive scores compared to other diseases. In addition, those patients underwent rehabilitation showed less number of cognitive problems compared to those who received routine care. Memory deficiency play key role in this regard, since experiences and knowledge are stored in memory, and to solve a problem or to identify the situations, memory is required. Memory deficiency can be effective in learning the rehabilitation activities (19). A cohort research performed on burn patients revealed that patients who carried out aerobic exercises had a higher oxygen capacity compared to those who received routine treatment. Exercise also improved cardiovascular status of these patients (20). There are few studies in this area. A study carried out by Dan Tong et al revealed that early rehabilitation not only improved physical function, but also improved mental health of patients (17). Hence, increasing oxygen supply to the brain, early mobility can improve cognitive areas in burn patients .The current study also revealed that the early mobility program decreased duration of hospitalization in patients. It seems that early mobility program to reduce the duration of hospitalization in patients by improving the neuromuscular status and improving independent function of patients and reducing the complications caused by lack of mobility. Findings of a study conducted by Christiane Perme et al on the impact of early mobility and walking program on patients admitted to intensive care unit revealed that early mobility and walking program can reduce neuromuscular and pulmonary problems and reduce the patient's dependence on the function and duration of hospitalization (15). Findings of a study conducted by Dian E. Clark et al to examine the impact of the early mobility protocol in patients admitted to ICU ward of burn and trauma revealed that the early mobility program in patients hospitalized in BICU and trauma reduces deep veins thrombosis, pneumonia, and airway complications and reduces hospitalization duration. This program also created a culture of early moving of these patients in these wards (8). Among the potential risk factors for musculoskeletal disorders, resting on bed is one of the risk factors that could be modified. The early mobility and rehabilitation might help for patients who are feeling very bad prevent or reduce the complications caused by immobility and improve the treatment results. Research suggests that early mobility and rehabilitation improve physical situation, reduce the duration of using ventilator, and duration of hospitalization in intensive care unit and hospitalization wards (21). Physical rehabilitation is a key element of burn care to improve the burn patient. The primary goal of occupational therapy and physical therapy after the burn is to maintain the physical function. Rehabilitation begins from the first day of patient's admission and continues up to improvement in the burn wound. As burn rehabilitation begins earlier, it will lead to increased reduction in contracture and hypertrophy in the wound. The treatment stages include proper position, motor range exercises, function exercise and stretching exercises (22).

Limitations of study

One limitation of the current study was non-participation of children. Therefore, it is not clear that if this program can be effective for children or not. Hence, it is recommended that a similar study to be carried out on children. In addition, scores related to cognitive subscale were improved after the early mobility in the present study, but it is not clear that if early mobility could improve the cognitive subscale or the recovery process caused such improvement. Thus, it is recommended that cohort studies to be conducted to find the causes of improvement in cognitive subscale.

Conclusion

Results of the current study revealed that using early subscale program can leave a positive impact on improvement of most of the independent functional areas and duration of hospitalization. Moreover, physical rehabilitation can help burn patients maintain their independence and have a useful life, since the goal of rehabilitation in burn patients is to achieve maximum physical function and help them return to their roles and life skills. Rehabilitation also leads into improvement in one's quality of life Thus, it seems that cooperation of rehabilitation team with the nursing team can help patients achieve maximum functional capacity and direct them toward normal life without any motor limitations (2).

Clinical applications

Given increasing improvement in care of burn patients and considering lack of a standard protocol and the problems created by motor delay in burn patients (muscular weakness, increased duration of hospitalization, and cost of treatment), it is recommended that a comprehensive plan to be developed at the level of burn centers so that the effectiveness of this plan to be proven and it is notified and implemented as a comprehensive protocol. It is also recommended that this plan to be included as part of routine practice in nursing care provided for burn patients. It seems that psychosocial and cognitive dimensions to be influenced by early mobility, while the current study showed the impact of these dimensions. Hence, it is

recommended that more complete studies to be conducted on these dimensions and early mobility. Cognitive screening is also recommended at time of admission of burn patients (23).

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